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CONSTRUCTIVE INTERACTION IN SCRIPTED COMPUTER-
SUPPORTED COLLABORATIVE LEARNING

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Constructive interaction in scripted computer- supported collaborative learning (CSCL)

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This study explores the constructive interaction of higher education students during the Facebook groups' discussion. The specific aims are investigating what forms of interaction were generated and how these interactions vary in three differently supported scripts. The participants of this study were ten small groups of higher education students (N=88) from three different Universities; collaborative learning for these groups was supported with a particular design micro- script for promoting both participation towards task-related and socio-emotional interaction over a six-week CSCL course. The results show that constructive interaction was rarely found. The majority of groups manifested more in the task-related than the socio-emotional categories. In terms of differences within the three collaboration phases, the intense constructive interaction was shown in the first and second tasks, where scripts were still supported students' collaborative activities. Based on the findings, it can be concluded that the group who actively contributed to socio-emotional interaction was likely to engage well in task-related performance.

Keywords: Computer- supported collaborative learning (CSCL), constructive interaction, task-related interaction, socio-emotional interaction, scripting

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Introduction

Computer-supported collaborative learning (CSCL) has been prominently recognized to open a new threshold of knowledge by facilitating the social nature of interactions mediated by various technological and pedagogical supports (Dillenbourg et al., 2009; Halavais, 2016). It encourages learners to actively participate in social interaction that harnesses everyone's unique expertise, experiences, and values to solve complex and undefined issues (Light et al., 1994; Van den Bossche et al., 2006). With this diversity, learners are able to nurture their abilities in learning, communicating, collaborating, and thinking critically to be well-prepared for 21st century societal need (Binkley et al., 2012). Equally important, the collaboration skills along with critical thinking and problem solving have been advocated as transversal competencies that should be highlighted in educational institutions (European Commission, 2012).

Additionally, The UNESCO's International Bureau of Education has released the normative document of the future curriculum that clearly advocated the ability to interact effectively with others as one of macro or stable competencies (Marope et al., 2017). This is referring to the specific skills that remain relevant across context and time. In this sense, the collaborative learning supported by technological tools and strategies hold promising spaces to engage learners in productive interaction and in performing the shared goals (Chen et al., 2018; Jeong et al., 2019). Thus, the participation in learning collaboratively via specific devices enable learners to acquire the appealing stable skill as mentioned earlier. Once they enter diverse learning or working environment in any given time, they have already prepared powerful skills that are likely to make them survive and thrive in the increasing complex world (Binkley et al., 2012).

However, the empirical studies have revealed the growing concern of the effective practice of CSCL. The gained popularity should be matched with its effectiveness (Järvelä & Häkkinen, 2002; Weinberger, 2006). The critical element heavily relies on the level of social interactions that learners possibly manifested during the collaboration processes (Dillenbourg et al., 2009; Vuopala et al., 2016). The emerging digital tools are expected to facilitate a high level of collaboration that refers to learners' engagement in constructive interactions (Laru et al., 2012; Näykki et al., 2019; Vuopala et al., 2019). One of which is knowledge-domain interactions that involve theoretical argumentation, intensive negotiation, and active questioning (Järvelä & Häkkinen, 2002; King, 2007). In addition to this, the interaction involving socio-emotional aspect is equally favored (Baker, Michael et al., 2013; Isohätälä et al., 2018; Näykki et al., 2019). It refers to the learner's familiarity, respect, and engagement with other group members

(Barron, 2003; Kreijns et al., 2003). This elaboration points out that learners cannot achieve desirable collaborative learning outcomes unless they engage in specific, meaningful interactions.

These notions then lead to the term of constructive interaction. It is said constructive when it can enhance collaborative learning (Baker, Michael J., 1999), the shared goals would be successfully achieved through elaborating qualified argumentation and negotiation as well as engaging in healthy group climate where everyone enjoys working and learning together (Isohäätä et al., 2018). This study, therefore, put task-related and socio-emotional interaction in the spotlight. The former serves the function to facilitate higher cognitive thinking, and the latter promotes desirable group cohesion. As indicated in several studies, only particular forms of interaction could foster a high level of collaborative learning (Baker, 1999; Vuopala et al., 2016); thus, these two perceived constructive interactions in this research are believed to promote successful collaboration.

Although such constructive interactions have been acknowledged as the precursor of desirable collaboration, learners keep finding difficulties engaging in meaningful activities (Baker, 1999). Thus, CSCL, as a pedagogical practice, could not serve its premises unless supported by appropriate scripts (King, 2007; Kobbe et al., 2007). The issue associated with the scripted CSCL environment is whether such scaffolding fosters or hinders the learning processes. Whereas the well-structured context could hurt one's sense of agency, exploration, and creativity, the non-scripted environment is potentially confused learners who possess less self-motivation or skills of learning and inadequacy of collaborative learning experiences (Rasku-Puttonen et al., 2003; Van den Bossche et al., 2006; Weinberger et al., 2010). The use of script as pedagogical support is expected to address both cognitive and socio-emotional aspects in learning (Näykki et al., 2019).

Moreover, in the concern to the general assumption of using technology for learning, which is seemingly effortless, it is indeed complicated in implementation (Dillenbourg et al., 2009; Gemmill & Peterson, 2006; Jeong et al., 2019; Resta & Laferrière, 2007). Utilizing state-of-the-art devices to facilitate learning and collaboration does not necessarily mean a group's learning is automatically involved in constructive interaction (Kobbe et al., 2007; Kreijns et al., 2003; Näykki et al., 2019; Weinberger et al., 2010). Thus, the support of scripts designed in various terms and purposes is critical, scaffolding learners to effortfully accomplish the joint

tasks and positively contribute to the group atmosphere (Näykki et al., 2019). And with numerous studies have been conducted on social interaction, the focus to include scripts in promoting such constructive interactions (task-related and socio- emotional interactions) in CSCL remains underrepresented.

The abovementioned elaboration then necessitates the importance of this study. A more profound analysis of Facebook conversations is expected to discover forms of interactions that the collaborators generated and find the variations between groups supported by the different scripts (fading out collaborations scripts). Therefore, this study's results would likely shed light on the effectiveness of different scripts to promote the constructive interactions that lead to the holistic performances in using the emerging digital technology as a collaboration tool for both cognitive and group desirable achievements.

Literature Review

A large body of research has revealed challenges belong to CSCL in facilitating its shiny premises (Chen et al., 2018; Jeong et al., 2019; Jones, A. & Bennett, 2017), and how the emerging technology devices supporting high level of collaboration has been the underlying challenge to be addressed (Vogel et al., 2017; Vuopala et al., 2016). High level collaboration means that learners are able to engage in specific socio- cognitive interactions, such as explaining, arguing, and questioning (Järvelä & Häkkinen, 2002; King, 2007). Through this participation, the acquisition of domain- specific knowledge (e.g., given topics intensely discussed) as well as cross-domain competencies (e.g., collaboration and argumentation skills) are potentially accommodated (Vogel et al., 2017). Other empirical studies similarly revealed the fact that well- performed groups involved in deep knowledge elaboration, intensive peer respond, and complex given questions (Järvelä & Häkkinen, 2002; Vuopala et al., 2016). Hence, learners cannot achieve desirable collaborative learning outcomes unless they engage in specific socio- cognitive interactions.

Carving further the path of successful practice of CSCL, few empirical studies indicated that achieving high- level social interaction is likely to be a severe obstacle during the small group collaboration. It can be mirrored in a recent study of (Vuopala et al., 2016) that even the three perceived successful groups based on grades, participation, and peer assessment, the quality of interactions they cultivated were still relatively superficial. Only one of the groups fairly achieved high-level collaboration, presenting theory-based knowledge and elaborating commentative discussions. They were similarly discovered (Hou & Wu, 2011) when they conducted a case study of higher education students using online synchronous instant-messaging tools. Surprisingly, the finding revealed that participants generated more than a half of off-topic discussions. The research differentiates the groups into high- and low-quality teams; the latter showed more diverse discussions and coordination. They indicated fewer discussion variations and lacked group coordination. Therefore, these suggested that the quality of interactions plays a significant role to determine the effective practice of CSCL.

The areas of improvement needed in CSCL practices are not limited to the cognitive domain. The empirical studies have shown that they are involved in multidimensional contexts whenever they collaborate . The cognitive processes could not be effectively manifested unless the social and emotional aspects are adequately addressed (Järvenoja & Järvelä, 2013; Näykki et al., 2014; Näykki et al., 2019). Knowing how the learners' co- elaborate knowledge

in a group and how they feel and relate to each other are the two critical dimensions that should be appropriately supported whenever they collaborate (Isohätälä et al., 2020; Kreijns et al., 2013). Successful CSCL is achieved when emerging digital tools can provide rich learning experiences and meaningful collaboration (Baker et al., 2013; Näykki et al., 2019). Successful collaboration always involve higher cognitive processes, maintaining a positive group climate (Isohätälä et al., 2018), equally participated and engaged in productive argumentation (Vuopala et al., 2016), and effectively coordinate and regulate emotional and motivational challenges for achieving joint goals (Järvenoja & Järvelä, 2013).

2.1 Computer-Supported Collaborative Learning

Collaborative learning, as the essential element of CSCL, is rooted in the theoretical framework of social constructivism learning theory (Salomon & Perkins, 1998). It highlights the knowledge co-construction through social interaction, meaning that learners engage in ideas sharing and opinions negotiating taken from divergent points of view aiming to acquire knowledge and achieve shared understanding (Stahl, 2006). It also refers to mutual engagement and intensive coordination of participants that fostering the continued effort to create and sustain a shared understanding of a problem (Roschelle & Teasley, 1995). Thus, collaborative learning prerequisites consist of two or more participants, holding mutual engagement and committing joint effort in achieving shared goals and knowledge construction.

From the perspective of socio-cognitive theory, which this study also leans on, collaboration is seen as a social venue that operates through individuals' involvement in cognitive processes, transforming one's knowledge through individual conceptual change (Asterhan & Schwarz, 2009). Thus, these require the learner's commitment to participate; otherwise, learning could not be facilitated (Vuopala et al., 2016). In that sense, such cognitive activities could promote agentic actions in group learning processes facilitated by teachers or other pedagogical supports (Kobbe et al., 2007; Weinberger et al., 2010).

Computer-supported collaborative learning (CSCL) has emerged to extend and transformed people's learning experience in forms of collaborative learning mediated with a wide range of technology tools (Dillenbourg et al., 2009; Jeong et al., 2019; Näykki et al., 2019). It broadens the learners' opportunities to take active control of their learning and interactions in which technology supports knowledge sharing and co-construction without time or distance barriers (Kreijns et al., 2003). Undeniably, CSCL has gradually progressed and adjusted to the

educational and societal demands (Jones, C. et al., 2010). Its movement started with the growing popularity of social software application or often defined as web 2.0. They were then followed by the more recent technological transformations, such as social networking systems (SNSs), gamification, and digital fabrication. Regarding these emerging digital tools, this study's context was taking one of which to be explored, namely the Facebook group used for the collaboration platform. It arguably holds a handful of promising academic potentials (Chen et al., 2018; Jeong et al., 2019), that potentially used as a social and learning platform (Judele et al., 2014; Tsovaltzi et al., 2017).

Prior studies have repeatedly revealed the fact that CSCL is a promising yet challenging learning practice (Gemmill & Peterson, 2006; Jeong et al., 2019; Resta & Laferrière, 2007). It indeed provides a wide range of group learning possibilities. However, it has been long recognized that the quality of CSCL may vary significantly: learning is rewarding and meaningful as the brightest narrative, but oftentimes it perceives as a tedious and exhausting process (Barron, 2003; Näykki et al., 2014). With the absence of physical appearance with powerful nonverbal social cues, the main challenge is promoting the quality of interactions (Järvelä & Häkkinen, 2002). Therefore, script support is fundamental in this study to enable the effective implementation of CSCL by scaffolding how learners engage in constructive interactions.

2.2 Scripting in supporting effective collaboration

Among the whole aspects involved, the teaching presence within the CSCL community constantly lead to the concept of collaboration scripts. These have been expected to guide learners' productive collaboration, including expressing opinions, reasoning, and arguing. In the emerging CSCL practices which has not just been aligned to the increasing culture of transformative education, it can also be purposefully designed to support various forms of collaborative learning and active engagement of knowledge acquisition in learners' communities (Weinberger, 2011).

Whereas the effective interaction has been recognized as the critical determinant for the successful CSCL environment, achieving such desirable interactions are rarely occurred as has been always expected (Kreijns et al., 2003; Vuopala et al., 2016). Then Collaboration scripts came as a viable solution in order to foster the interactivity among learners during their collaboration with help of technology (Fischer et al., 2013; Kreijns et al., 2003; Vuopala et al., 2016; Weinberger et al., 2010; Weinberger, 2011). According to (Kobbe et al., 2007), collaboration

scripts are based on the scripted cooperation approach, which includes activities aiming to foster collaborative learning by structuring interaction between learners.

Because of these powerful impacts they might bring, it is worth mentioning that the interactions among group members are the central of collaborative learning. These shows learners to proactively engage in productive interactions that involve asking thought provoking questions, explaining and justifying their thoughts, expressing their reasoning, and elaborating as well as reflecting upon their acquired knowledge. Nevertheless, evoking these cognitive processes does not simply shed light on what learners do, but also on how they do it, which seems equally imperative.

Furthermore, establishing environments that cultivate rich social interactions is highly favored (Vuopala et al., 2016). One of the popular approaches is called micro- script which is aiming for shaping group interactions by designing a communication tool for learning, for example semi- structured settings that trigger learners' engagement using sentence openers. Others can be in a form of question prompts or detailed instructional supports that are often perceived to be faded gradually as individuals become more competent (Kobbe et al., 2007; Weinberger, 2011).

Apart from these pedagogical terms, (Kobbe et al., 2007) advocated external scripts as the foundation of the configuration of internal scripts which in turn reflect the learners' ability to understand and act in learning practices are equally worth mentioning in this study. Fading, for example, which means gradual reduction of support provided externally in order to give the learners the chance to apply what they learned in collaboration (Fischer et al., 2013), is considered as a crucial element to avoid over- and under scripting, which is proven to greatly affect learning processes and outcomes. Additionally, the idea of fading plays a great role in adjusting the external scripts provided according to the authentic conditions that learners are facing. For example, the gradual removal of a special application support (Fischer et al., 2013; Kobbe et al., 2007).

2.3 Constructive interactions in CSCL

Interaction in a social context is a key to this study. It is indeed a broad term that can be interpreted from many lenses. From a Sociology and Psychology perspective, social interaction is defined as the unique occurrence of social conditions where two or more people agreed on each

other physical responses (Goffman, 1983). These might consist of speech and nonverbal social cues, such as facial expressions, tone of voice, posture, and gaze (Argyle et al., 1970). This takes a different stance when it comes to the CSCL environment, which is apparently the absence of such important verbal and nonverbal communication (Järvelä & Häkkinen, 2002). The form of interaction is through text-based conversation and written emoji, images, or pictures which are the unique yet challenging way of ideas delivery and self- expressions.

Concerning the explanation mentioned above, the interaction in CSCL is challenging in nature. The prior empirical research indicated that simply facilitate social interaction through a piece of device isn't enough to foster effective social interactions (Kobbe et al., 2007; Kreijns et al., 2003; Weinberger et al., 2010; Weinberger, 2011). Hence, there is an underlying need to be facilitated with pedagogical supports, e.g., collaboration script (Fischer et al., 2013; Kollar et al., 2006). With this instructional design provided, learners are able to engage in a productive interaction (Vogel et al., 2017). In line with collaborative learning research, the high level of interaction generated within the social setting can be a key determining factor towards one's learning (Vuopala et al., 2016). However, the tricky part is not all interactions cultivated by participants in a group can be put at the desirable level of collaboration discourses. They are only the specific forms of interaction in which potentially lead to successful collaborative learning (King, 2007).

Therefore, constructive interaction is utilized to emphasize the primary function of certain discourses that are incredibly needed to achieve desirable outcomes in learning collaboratively. (Miyake, 1986) coined the term "constructive interaction" to deliver a concept in which guided people to comprehend a complex tool (a sewing machine) in a meaningful iteration, between understanding and non-understanding. Besides, another study perceived interaction could be constructive in two stands point in the problem-solving case. It is started with the exact definition of constructive in a way that enables co-construction of knowledge or creation or something, e.g., meaning, understanding, and solutions. At the same time, another perception of constructive meaning is associated with goal-oriented processes. When working in groups to solve problems, individual learners involve exchanging ideas and negotiating divergent opinions that are supposed to foster a shared understanding of the joint tasks, not the way around. Thus, these perceived constructive interactions are able to facilitate knowledge acquisition and goal achievement (Baker, 1999).

Based on the elaborated prior research, we define constructive interaction to the extent that learners can create and sustain productive and meaningful interaction to acquire content knowledge and develop group cohesion. These refer to the task-related interaction, how they productively engage in argumentation and knowledge co-construction. Simultaneously they also participate in socio-emotional interaction related to the group atmosphere created within the collaboration and how learners mutually contribute towards a respectful and emotionally supportive environment.

In addition to these descriptions, the task-related and socio- emotional interactions were chosen to fit into the constructive meaning because of several reasons. (Kreijns et al., 2003; Kreijns et al., 2013) eloquently advocated the purpose of social interaction to create the two substantial collaborative learning processes. Cognitive processes and socio-emotional processes are broadly categorized through the manifestation of specific social interactions. The former refers to the group's thinking processes and co- elaborating knowledge in which the expected outcomes are related to the learning performance. Whereas the latter represents the processes in which learners interact and relate to each other- interpersonal dimension (Järvenoja et al., 2018); and learners' perception and feeling about the collaboration- emotional and motivational dimension (Järvenoja & Järvelä, 2013). In other words, it can be described as a process of getting familiar with each other, standing still to the social relationship, developing trust, and building a sense of community (Kreijns et al., 2003).

Based on these empirical studies, the smaller parts of which have been interpreted as constructive interaction. Presumably, by taking the specific forms of interactions among a wide range of activities involved, this would give a clearer picture of how the script could activate learners' constructive contribution in the text-based discourses. Then ultimately lead to the holistic group performance- cognitive and socio-emotional performance- to answer the CSCL premises.

2.3.1 Task- Related- Interaction

The cognitive performance has been exponentially attracted many researchers in the learning science discipline, not to mention in CSCL research (Dillenbourg et al., 2009; Jeong et al., 2019; Vogel et al., 2017). This is broadly introduced that task-related interaction can be seen as a minor part of the complex cognition dimension in CL. As (Kreijns et al., 2003) suggests, in

cognitive processes, learners are involved in broadening their understanding via thinking, reasoning, and co-elaborating knowledge. This also can be extended to the activities related to the group's regulation that involves planning, monitoring, reflecting, and activating metacognition to achieve successful collaboration (Järvenoja et al., 2018). Arguably, this content-related interaction is the foundation of focusing on the center of learning in which everyone holds the awareness to harness social affordances as a group (Järvenoja & Järvelä, 2013). Therefore, learning could be appropriately managed, and group performance would be successfully achieved (Hadwin, Järvelä, & Miller, 2018).

Some other studies suggest that the high-level discussions were merely characterized by theoretical argumentation, mutual negotiations and questioning (Järvelä & Häkkinen, 2002; King, 2007). Olivera (2011) echoed in their research that the strong perspective sharing on the discussed topic with intense negotiations acted as a catalyst to promote desirable group's learning processes. It seems that when groups pour decent effort in knowledge-domain discussions, they will likely cultivate outstanding learning performance.

Taking perspective on the aforementioned scientific work, task-related interaction in this study refers to all groups' interactions about the provided contents and about their process of learning (Dillenbourg et al., 2009). These could be manifested through sharing, elaborating, and processing knowledge about the domain-focused content (Hmelo-Silver, 2003).

2.3.2 Socio- emotional interaction

Students when working together, will exhibit wide range of interaction as the core of collaboration while attempting to expand its concentration to understand and address ideas of other peers and to reflect their own (Dillenbourg et al., 2009). Such interactions will function in inseparable entities between cognitive, socio-relational and contextual dimensions of collaboration (Järvenoja & Järvelä, 2013). This creates an insight that cognitive capacity does not operate alone in collaboration, there must be emotional reactions as well as social challenges occur simultaneously (Mirza, 2013).

Despite the prominent role of cognitive dimension discussed previously, Socio emotional aspect also plays a critical function for fostering successful CSCL. Socio-emotional dimension in collaborative learning can be elaborated in various different concepts, including social and emotional processes (Barron, 2003; Kreijns et al., 2003). These concepts specifically highlight

learners' capabilities to initiate personal and collective regulations whenever the emotion- motivation related challenges unfold within the social context (Näykki et al., 2014). Such abilities, therefore, open up more room for creating psychological safety and promoting healthy atmosphere where trust and sense of community heavily relied on (Kreijns et al., 2003; Rogat & Adams-Wiggins, 2015). Socio- emotional dimension is defined as social processes when learners nurture such dynamic interpersonal interactions to positively affect group performance (Van den Bossche et al., 2006). These are likely to represent how each individual participates as a part of the group that could fully committed to develop ideas and support others to progress toward the collaborative tasks (Altebarmakian & Alterman, 2019).

Different objectives, interpersonal dynamics, and competing priorities and expectations are perceived as possible challenges. When these emerged within social context, the participants' reaction would likely to shape the atmosphere of the group, whether it creates positive and healthy atmosphere or it might interfere group's emotional and motivational balance (Järvenoja & Järvelä, 2013; Järvenoja et al., 2018). Unlike socio-cognitive conflicts in which is perceived as constructive processes (Decuyper et al., 2010), socio- emotional challenges can be negatively affect groups cohesion, individual and group commitment as well as collective satisfaction and performance (Jehn & Mannix, 2001). Based on these empirical findings, socio-emotional dimension can bring profound contributions to successful collaboration, hence, sufficient efforts and concerns are required.

Acknowledging the profound roles of Social and emotional aspects in collaboration, specifically using Facebook group, there should be more adequate and relevant supports for the better implementation of CSCL experiences. An observation of group members' specific interactions; task- related and socio- emotional conversations could possibly open up the insight to deeply understand how these particular interactions which supported by fading out scripts affect the group performance. This is not entirely about the knowledge attainment ultimately, but also how they are interrelated and could potentially promote dynamic and healthy atmosphere in the collaborative learning. And the hypothesis is the tighter the script was, the more aware the learners to contribute equally to both constructive interactions (task- related and socio- emotional interactions). It is assumed that the scripts would serve the function of promoting the active participation on the joint task as well as the awareness to create and maintain the desirable group cohesion.

Aim and Objectives

The aim of this study is to figure out what forms of interactions occurred when learners collaboratively working in Facebook group and also to compare the variations between the groups using micro- script which had been faded out during the collaboration phases. This analysis could lead to perspective of constructive interactions that assumed as profound contribution to the successful collaboration. The components of succeeding might include cognitive (task- related interaction) and social dimension (socio-emotional interaction) in collaborative learning using social networking sites. Specific research questions are:

- RQ1 : Which forms of task- related and socio- emotional interactions occurred during the course?
- RQ2 : How did the interaction forms vary between three differently scripted collaboration tasks?

Research Methods

4.1 Context and participants

This study's participants were higher education students (N= 88) from three different Universities, one was from Germany and the other two Universities were from Finland. The course they participated was called Computer supported collaborative learning (CSCL) within six-week timeframe, discussing respectively about the underlying relevant topics in CSCL: scripting, motivation and emotions, and metacognition. Ten groups were formed with four participants and one teacher- tutor for each were collaboratively working on those previous mentioned topics. There were phases in this collaboration, starting from the introduction and orientation that aiming for forming positively group atmosphere through closely knowing each other at the first beginning week. Then they discussed each presented topic in two consecutive weeks within their closed Facebook group.

The groups were supported with the micro- script that has been faded out during the online collaboration. These provided scripts would likely guide learners into productive knowledge co-construction and argumentation (Noroozi et al., 2012; Weinberger et al., 2007). The study was specifically designed with supports of preassigned roles and sentence openers to support learners to not only engage productively in argumentation but also to equally participate and to actively motivate each other (Näykki et al., 2019). The roles included: captain (provided support for group's member participation), contributor (facilitated peers to identify and elaborate pro- arguments), critic (supported for identifying and elaborating counter-arguments), and composer (created a synthesis of the pro-and counter-arguments). Such sort of detailed scaffolding was expected to prompt learners to not only pay attention to the task-related interaction but also to the socio-emotional interaction. Due to the awareness of an overly scripted environment that could impede collaboration, the faded-out was implemented (Noroozi et al., 2018). The roles and sentence openers were used during the first two weeks of collaboration, whereas the next phase was the absence of sentence openers and only supported by the given roles. The roles were differently assigned due to the awareness of the equal contribution of all collaborators. Then finally, the script was entirely faded out in the remaining last two weeks. The expectation was to enact the concept of internalizing script where learners are already experienced and no need for external support (Noroozi et al., 2018).

4.2 Research data

The data consists of ten groups with three tasks involved per each. The whole discussion notes from those groups and tasks, 30 units altogether, were analyzed to discover how the learners interact during the course. These units were divided according to the following categories with three subcategories per each: task-related interaction consists of new knowledge, question, and answer and comment while socio-emotional interaction includes expressing cohesion, decreasing tension, and accompanying.

4.3 Data analysis method

The method used is based on the qualitative content analysis. In quantifying the results of qualitative analysis, descriptive statistics were also utilized. Then data analysis progressed through general and detailed phases analyzing the meaningful unit of Facebook groups' conversation. The discussion notes as the unit of analysis should be associated with the task-related and socio-emotional aspects and excluded the irrelevant parts, such as teacher's conversation. The coding scheme (see Table 1) was purposefully developed based on the coding framework advocated by (Järvelä & Häkkinen, 2002; Vuopala et al., 2016; Weinberger, 2006).

The first step was dividing the whole discussion notes into group and task categories. Ten (10) groups were then formed with three tasks per each, following the three phases of collaboration with different support scripts. The first group was facilitated by a micro script that consisted of sentence openers and preassigned roles. Whereas the second task only prompted specific roles, the last one was entirely faded out. Until it was neatly divided into 30 (thirty) coding groups (i.e., Group 1 task 1, Group 1 task 2, group 1 task 3), then they were coded using the qualitative data analysis software, NVivo 12. The units coded then being analyzed twice; the first focus was the number of references and the percentage coverage to discover the forms of interaction during the collaboration, representing the general picture of interaction produced from all groups. After that, each category and subcategory were observed in more detail to discover the variations between groups within the three tasks of group collaboration with different provided scripts. Finally, another researcher implemented cross-coding comparison, and Cohen's Kappa values were defined. Kappa values for the task-related was 0.63, and the socio-emotional interaction was 0.84.

Table 1. Coding scheme for online discussions

Main category	Subcategory	Coding rule	
Task- related interaction	New knowledge	Theory- based	Brings new topic based on theory
		Experience – based	Brings new topic based on experience or opinion
		Statement	Brings new topic as statement without explanation
	Question	New question	Brings new question into discussion
		Clarifying question	Clarifies previous question or asks for clarification
		Suggestion	States or suggests and waits for comments
	Answer or Comment	Declaratory comment	Agrees, states repeats
		Comment with explanation	Explains, justifies, clarifies
Socio- emotional Interaction	Expressing cohesion		Helping, rewarding, acknowledging
	Decreasing tension		Laughing, joking, sending pictures/ emoji
	Accompanying		Expressing presence, mumbling

Results

5.1 RQ1: Which forms of task- related and socio- emotional interactions occurred during the course?

The general overview of interaction forms cultivated by the ten groups within the collaboration phases revealed that the task- related interaction showed substantial number than socio- emotional interaction (see figure 1). In all ten groups, discussion notes were 1855 in total, 1334 discussions for task- related and 517 discussions for socio- emotional part. Most of the task- related interactions were related to the answer and comment which generated 564 discussions. Whereas other two subcategories were accounted fairly similar number, 364 and 390 discussions.

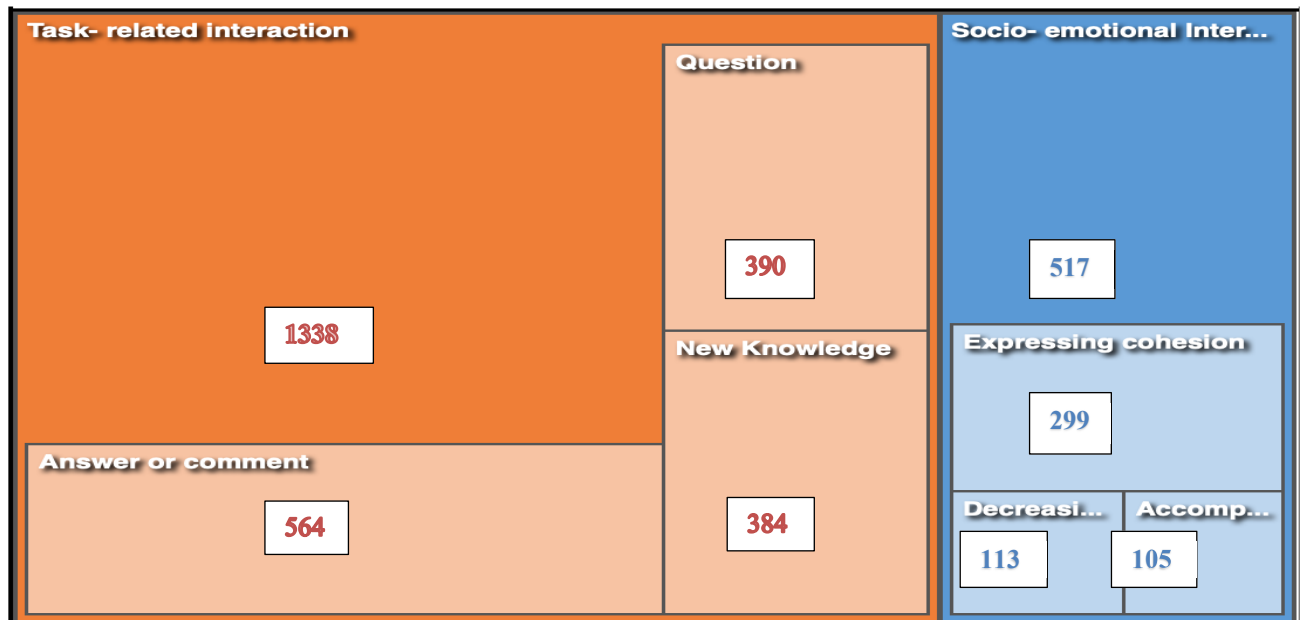


Figure 1. The general picture of interaction forms occurred during the three collaboration tasks (the numbers refer to the amount of discussion notes per each category).

Although interaction related to giving agreement, reasoning, and explaining were frequently found within the group's collaboration (564 references), discussion associated with elaborating theory-based knowledge hit the profound amount of coverage between 28 % - 73 %. The following examples represent the majority interaction occurred within the group's collaboration processes.

5.9.2

"I would partially agree with you regarding the statement that participating in a social learning situation can trigger the metacognitive process more easily and make students aware of their cognitive skills.

However, as we see from the definition provided about self-regulated learning, Self-regulated learning has been defined as an active, constructive process.....

2. 9.2

"The authors mention a study by Webb (1989) that provided evidence that constructing explanations helps the students to become aware of their thinking, of the missing knowledge and lack of understanding.

Conversely, the socio-emotional coded references were 517, in which expressing cohesion took dominant spaces while the others two subcategories were only halved, 113 and 105. In general, there were more socio-emotional interaction in the beginning of the course and then shown a decrease as the script was being faded out. Hence, most groups were likely to set aside the focus on the manifestation of socio-emotional interaction in which the coverage percentage itself was accounted for only between 1%- 18%, far below the former.

Most often, the socio-emotional interaction was related to giving compliments and rewarding peer's participation.

2.4.3

Thank you for sharing this idea that shared metacognition can be reached if there is "the highest level of collaboration".

3.4.3

Kaisa, you shared a very good point of the topic. "...

Even though throwing jokes and sending emojis to decrease tension were less frequent, the majority of groups attempted to generate these conversations every phase of their collaboration.

2.2.2

Haha, you both are confusing me really by stating the same things ^^.

3.4.3

Yaay, Shameer Ali Prasla, first "metacognition regulation message"□

5.2 RQ2. How did the interaction forms vary between three differently scripted collaboration tasks?

The detailed analysis revealed variations between collaboration tasks. The majority of groups showed the most frequent conversation for both task-related and socio-emotional units within the first and second tasks. In contrast, the minor references were mostly found in the third collaboration phase (see table 2).

Table 2. The highest discussion units coded per subcategory in three different tasks

<i>Grouping based on the highest references coded</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Task-related interaction				
<i>New knowledge</i>	<i>Task 1 (group 4)</i> 42 (34)	<i>Task 2 (group 4)</i> 32 (39)	<i>Task 1 (group 2)</i> 31 (67)	<i>Task 3 (group 2)</i> 29 (72)
<i>Answer or comment</i>	<i>Task 1 (group 4)</i> 76 (54)	<i>Task 2 (group 4)</i> 60 (51)	<i>Task 1 (group 9)</i> 59 (38)	<i>Task 1 (group 8)</i> 46 (45)
<i>Question</i>	<i>Task 1 (group 4)</i> 51 (11)	<i>Task 1 (group 9)</i> 27 (10)	<i>Task 2 (group 4)</i> 25 (11)	<i>Task 1 (group 2)</i> 25 (10)
Socio-emotional interaction				
<i>Expressing cohesion</i>	<i>Task 1 (group 4)</i> 39 (4)	<i>Task 2 (group 4)</i> 34 (4)	<i>Task 1 (group 1)</i> 33 (7)	<i>Task 1 (group 8)</i> 16 (3)
<i>Accompanying</i>	<i>Task 1 (group 1)</i> 14 (11)	<i>Task 1 (group 8)</i> 12 (15)	<i>Task 1 (group 4)</i> 10 (3)	<i>Task 1 (group 9)</i> 8 (6)
<i>Decreasing tension</i>	<i>Task 1 (group 1)</i> 22 (2)	<i>Task 2 (group 4)</i> 13 (2)	<i>Task 2 (group 2)</i> 13 (2)	<i>Task 1 (group 4)</i> 10 (2)

The following description would specifically elaborate on such variations within the three collaboration phases.

▪ ***First phase of collaboration (preassigned roles and sentence openers)***

In general, the task-related units showed much intense interaction in the first task in which learners were equipped with clear roles and sentence prompts (see table 2). There were several groups relatively elaborating knowledge deeply, responding peer's argumentation intensively, and, asking complex questions (Järvelä & Häkkinen, 2002; Vuopala et al., 2016). In terms of socio-emotional interaction, the highest number of references found in the first phase was related to expressing presence that aiming for getting closer to each other.

5.7.1

Hey folks,

my name is Tim and I am a first semester student of EduTech in Saarbrücken. I come from a teaching background as i studied for a teaching degree for english and history for secondary schools.

Also, the member's encouragement towards each other's participation in this task seemed intensively manifested, although it contributed minor compared to previous category.

4.4.1

Hello guys, same here - anything to add? Do you agree on our conclusion?

3.4.1

What is your opinion Michael?? Anything you would like to add?

▪ **Second phase of collaboration (preassigned roles)**

In the category of task-related, the flow of interaction seemed to be manifested similarly to the previous phase. However, only a few groups represented the constructive interaction (profound knowledge elaboration to contribute towards the cohesive group atmosphere). The roles assigned still supported the groups, although these were shifted compared to the first phase to prompt equal contribution among participants. Therefore, the most striking differences in terms of constructive interactions in this collaboration step were related to adjusting to the new roles, such as:

2.8.2

I have to admit that I find my role as a critic this week extremely difficult.

4.9.2

And my role as a composer I have to find the fundamental connections in relation with the pro/counter arguments.

Also, in the contribution towards socio-emotional part, there were more frequent motivating sentences in the attempt to continue the constructive interactions among the group members in this second phase.

2.9.2

Ok guys, Here is one first positive point to get us started.

2.1.2

I think that Friday would be a nice deadline.

▪ **Third phase of collaboration (with no script)**

The last collaboration phase was the most challenging part for almost the whole group. The script was totally faded out, and the groups were struggling to maintain constructive interaction. The interaction related to the task domain was mostly jumping quickly to the conclusion without any further argumentation compared to the previous phases. As clearly indicated in the prior research that there were possibilities within the collaboration processes where learners cultivated quick consensus (Weinberger, 2006) or false consensus (Weinberger, 2008).

2.7.3

It seems to be so.

3.10.3

Fine then

3.2.3

Oh good idea! That sounds perfect to me,

The variation was also apparent in terms of the effort of participants in generating such constructive interaction. The picture that represented the current struggles revealed in the discussion notes as follows:

2.6.3

I also will try to complete as soon as possible.

3.9.3

the same case goes for me, as well. Still dealing with the readings but not much left, hopefully will be back tonight...

Discussions

This study observed how higher education students from different universities collaborated through Facebook groups to engage in constructive interactions. The fading-out script was utilized to facilitate such interactions that consist of two forms: task-related and socio-emotional interactions. The findings indicate that constructive interaction was scarce among the groups, meaning they were likely to engage in intensive knowledge elaboration but relatively failed to cultivate socio-emotional interaction. As advocated in the prior research that learners in collaborating should strike a balance between participation in cognitive interaction as well as engagement in the socio-emotional realm (Isohätälä et al., 2018; Isohätälä et al., 2020; Vuopala et al., 2016). Without the awareness of each individual participating as a part of the group that fully committed to developing ideas and supporting others to progress toward the collaborative tasks (Altebarmakian & Alterman, 2019), the groups barely achieve successful collaboration.

However, the interesting result of this study shows that the intense argumentation and co-constructing knowledge followed by sincere compliments and motivating conversations, even though they occasionally occurred, tend to foster desirable group outcomes. This is aligned with (Engle & Conant, 2002) research that the constructive engagement of socio-cognitive performance is likely to involve solid emotional features. Also, it is worth emphasized that the higher level of affirmation, agreement, and acceptance could foster the perceived successful group to maintain a higher rate of reasoning in co-construction activities (Hogan et al., 1999). Conversely, groups who were less engaged in socio-emotional interactions were likely to struggle in maintaining constructive interactions for the whole collaboration phases. As pointed out in prior research, ineffective communication tends to be influenced by the discrepancy of willingness to understand each other. When this critical feature is absent, it impeded the groups' productivity (Hogan et al., 1999). When it comes to the script, the groups generated more frequently in the task-related unit in the first and second tasks, which were supported by the script. The socio-emotional part was more intense at only the beginning of the course when fully supported by roles and sentence prompts. These results resonated with the prior studies that CSCL tends to benefit from the additional support (script) of engaging learners in specific, constructive activities (Vuopala et al., 2019; Weinberger et al., 2010; Weinberger, 2011).

This partial success in cultivating constructive interaction is worrying since the experiences and skills through this collaboration considered as transversal skills (European Commission, 2012) and stable competencies (Marope et al., 2017). The skills that potentially acquired

through CSCL environment. Hence, the result of this study advocates the proper design of online collaboration that involve both participation in cognitive and socio-emotional interaction (Isohätälä et al., 2018; Isohätälä et al., 2020; Vuopala et al., 2016). The adequate support with the script that equally favors such profound interaction also highlighted (Kreijns et al., 2013; Näykki et al., 2019).

Conclusions

This study illustrates how both task-related and socio-emotional interactions are supported each other to achieve successful collaboration. And the fading-out script holds the potential to prompt such constructive interactions that ultimately lead to desirable learning and group performance. Hence, this study is able to raise awareness for the true purpose of participation in the CSCL course that is not merely for passing the course or getting the flying-colored grade. Still, they are willing to jump into the unknown of collaborative learning adventures in order to enrich their experiences in problem-solving, teamwork, and interpersonal skills. In the diverse environment that CSCL can offer, not only learners will ultimately acquire new knowledge but also enjoy the moment of each collaboration phase.

Additionally, despite the challenges that have been recognized to achieve the effectiveness of CSCL, this study opens up the perspective that CSCL, as the emerging pedagogical practice, is not entirely associated with “hype” but lies “hope” in its implementation. Through the appropriate design script with equal support for both cognitive and socio-emotional aspects, there are possibilities to promote learners to perform well academically and socially through the CSCL environment. Therefore, these findings can guide teachers, educators, and learning designers to organize the CSCL course effectively. However, it is worth considering that the low efficacy and unfamiliarity among the participants. And Facebook that notoriously holds the privacy issue altogether presumably acted as the major stumbling blocks to interact constructively with other group members.

This study also holds its limitations. The course only occurred in six weeks, potentially leading to the lack of time to get familiar with each other. Hence, the result would be different when it had given a longer time. The participants also considered small-scale, which might contribute to the insignificant sample to draw a conclusion related to relations of constructive interactions, forms of interactions, and scripts.

Successful collaboration could be achieved when learners participate in constructive interactions that are properly supported with scripts, as indicated by this study. However, future work is needed to deeper analyze the collaboration processes instead of coding the interaction forms and counting the codes. Since interaction consists of sequences that possibly influence the effectiveness of scripts, a process-oriented study should be conducted. Most importantly, Facebook provides more features to facilitate collaboration in the educational context, which

opens up research opportunities to carry out in the future. Finally, the ethical aspects of data collection were carefully considered that before the class started, all students were adequately informed of this course that holds research intention. Also, the privacy of the participants as Facebook users was highly acknowledged, and the data taken was utilized responsibly.

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